MONTHLY WEATHER REVIEW,

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WAR DEPARTMENT,

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DIVISION OF

TELEGRAMS AND REPORTS FOR THE BENEFIT OF COMMERCE AND AGRICULTURE.

INTRODUCTION.

The current Weather Review is compiled from information furnished by eighty-five regular United States Signal Service Stations, twelve Canadian Stations, seventeen U. S. Army Surgeons, one Naval Hospital, two hundred and sixty-nine Volunteer Observers, and from newspaper reports of weather and storm-phenomena.

The chief features of the month's meteorology were: (1) The frequency and destructiveness of local storms and tornadoes in the interior and trans-Mississippi sections of the country, greatly impeding travel and transportation, and inflicting serious damage upon the turnpikes and railroads, and loss of property in many towns and cities, as well as causing great disaster to all growing crops and grain standing in the fields. (2) The extremely high mean temperature in the South Atlantic and Gulf States, and also the prolonged drought in the cotton producing belt. (3) The low temperature in the Upper Lake region. (4) The extraordinary precipitation in the Ohio valley and Tennessee and the districts to the northwestward, preparing the way for the serious and destructive freshets and floods, which ensued after the month of July closed. (5) The scarcity of auroral displays. (6) The encouragingly few reports of grasshoppers and locusts in the agricultural districts.

ATMOSPHERIC PRESSURE.

The average monthly distribution of pressure is given on Chart No. II. From this it will be seen that the highest mean pressure, as usual for July, was in the South Atlantic and East Gulf States—where, also, prevailed the highest temperatures. The area of lowest mean barometer was in the Northwest.

(1.) *Areas of High Barometer.*—There were, during the month, five well-defined areas of high barometer, which, with one exception, came from the Northwest and Lake region; the last of these was of great importance in determining the serious weather-conditions of the two last days in July.

I. On the last day of June, a decided area of high pressure (noticed in the June Weather Review) progressed over the Lake region in a southeastward direction, and made itself felt on the 1st of July, by cool and generally cloudy weather, over all sections north of the Ohio valley, and in the Middle States, except Virginia. There were frequent rains following this area in the Lake region, and southwestward to Missouri and Tennessee. This high barometer passed off the Middle Atlantic coast on the 2d and 3d of July; but, after so doing, it worked along the coast southwardly, and with accessions of pressure off the South Atlantic coast, remained nearly stationary there for several days, but unaccompanied by any peculiar circumstances.

II. On the 6th another decided area of high barometer was reported from the upper Mississippi valley and the Northwest, producing a general reduction of temperature everywhere north and west of the Ohio valley. This area became most clearly marked and central in Minnesota on the morning of the 7th, when the unusually high

pressure (for the season) of 30.36 inches was reached, the thermometer falling to 60° or below. The area slowly advanced southeastwardly to the Ohio valley and Tennessee, and, by midnight of the 7th, extended from the Lakes to the Gulf, but unattended by cloud or rain of any consequence, except in the lower Mississippi valley. After this date it slowly diffused itself over the Lower Lakes and the Alleghany region, and on the morning of the 8th the whole country east of the Mississippi river was under a pressure of from 30.20 to 30.30 inches. Accompanying this, on the immediate Atlantic coast, were light rain-fall and general reduction of temperature, with northerly and easterly winds. This area passed off the Atlantic coast during the night of the 8th, and remained nearly stationary for sixteen hours.

III. On the 18th, after a long interval in which the pressure was generally low, a third noticeable high barometer appeared in the Upper Lake region and slowly developed eastwardly to the Lower Lakes, and thence over the Middle States, with decidedly cool weather and northerly winds. On the morning of the 20th, it had passed off the Middle Atlantic coast, whence it immediately disappeared.

IV. A noteworthy rise of the barometer was reported from the South Atlantic and Gulf States very generally on the 25th and 26th, owing, perhaps, to higher pressures in the Atlantic ocean north of the West Indies. This high pressure area in the south remained until the afternoon of the 27th, but no noticeable phenomena were connected with it.

V. On the morning of the 30th, an important and apparently extensive area of high pressure was reported from the Northwest and the Upper Lake region, slowly extending southeastwardly, with cool weather and northeast and northwest winds over the Lake region. This was the precursor of those heavy and torrential rains that subsequently fell in the last two days of the month in more southerly and easterly parts of the country, and constitute a significant element of the month's meteorology. On the afternoon of the 30th, as this high pressure forced its way southward, its cool, northerly winds meeting the warm and vapor-laden winds from the lower Mississippi valley, covered the country from Minnesota to Texas with cloudy weather, which, with continued reduction of temperature, and condensation, gave heavy rains in the lower Mississippi valley and Texas. This long rain-belt now began to extend eastward into the Ohio valley, which it reached on the night of the 30th, with precipitation that was very seriously felt along all the principal water-courses. The rains, too, were very heavy on the 31st in the central Mississippi valley, in some places exceeding four inches in 16 hours. The high barometer still remained over the Lake region up to the close of the month, serving as a feeder of cold air to condense the vapor in the warmer and moist air of the regions south of it. The low temperature was diffused over the Middle States on the 31st, and was effective in producing heavy rains. But the further and interesting history of this high barometer, in connection with low barometer No. VIII, belongs to the August Weather Review.

(2.) *Areas of Low Barometer.*—With one or two exceptions, these areas have been of an ill-defined and feeble type, and, though influential (in connection with the high barometer areas) in producing the numerous and destructive local storms and heavy rains of the month, they have been productive of but few high winds on the Lakes or along the Gulf and Atlantic coasts.

The total number of low barometer areas for July, worthy of notice, is eight. But the last of these had but partially developed, when the month closed; its history, therefore, will mainly belong to the August Weather Review. The tracks of these areas will be found on Chart No. I.

No. I. The first depression calling for remark was definitely observed on the mid-

night of the 1st, then in Western Kansas, and moving at the usual rate of speed towards Lake Superior. As it crossed the upper Mississippi valley, it was attended by heavy rains, which extended eastward to the Ohio valley and Tennessee. Thus, in the beginning of the month, commenced the rain-fall which has proved so disastrous in many of the interior agricultural districts. This first area passed away over the Upper Lake region on the 3d and 4th, with frequent but gentle rains in that section.

Accompanying this depression there were some violent local storms. One of these was felt, in terrific force, on the 3d, near St. Joseph, Missouri. Another was reported, on the afternoon of the 4th, from the vicinity of Denver, Col., with heavy hail and rain, which proved very destructive. The Denver and Rio Grande Railway, and the Denver Pacific, were damaged in several places, and the wheat crops injured in the surrounding country.

No. II. This low pressure area passed along the northern frontier of the country, having entered the field of observation a little northwest of Lake Superior late on the 9th, and, crossing that Lake in a direction east-southeast, traveled over Lake Huron and thence to the St. Lawrence valley, vanishing beyond the Nova Scotia coasts, after midnight of the 11th. There was nothing unusual in its progressive velocity; but, after passing the St. Lawrence valley, the pressure in the centre fell quite decidedly. It was, comparatively, a dry storm, and was attended by no dangerous winds.

No. III was, also, a Lake storm, though of an undecided type, and rainless through the larger portion of its central track. Approaching the Lakes from Minnesota, its course lay near the central Lake-line, bending a little to the south, until after it reached the mid-St. Lawrence valley, when it deviated to the northeastward, and probably entered the North Atlantic Ocean on parallels north of Newfoundland. Its progress through the United States and Canada lasted from the midnight of the 11th to the afternoon of the 14th, when it disappeared.

No. IV. a much more decided depression than its two predecessors—was first reported from Dakota on the 14th, and its path was more to the southeastward than Nos. II and III. The Dakota barometers, on the night of the 14th, were reading as low as 29.40 and 29.50. The advance of this area across the Lake region was marked by considerable precipitation, exceeding half an inch of rain, in many places. This rain-fall was rather greater as the depression traversed the mid-St. Lawrence valley, and proved, occasionally, very heavy on the coasts of New England and Nova Scotia, towards which it moved, and off which latter it disappeared at the close of the 17th.

No. V. This depression was the first of the month, whose origin and course were wholly within the interior of the United States. It was first distinctly traceable in Kansas and Nebraska on the 16th, and, thence, moved nearly due east to the Middle Atlantic coast, with unusual progressive velocity, its highest speed reaching nearly thirty miles an hour, from the midnight of the 17th to the afternoon of the 18th, when it was lost sight of beyond Sandy Hook. It was attended, at the first, by very heavy rains in the Missouri valley during the night of the 16th, on which a rain-fall of two inches occurred at and near Omaha. While moving rapidly south of the Lakes frequent rains fell, and, following its passage, both frequent and heavy rains were reported from the Lower Lakes.

As this area of low barometer was forming on the 16th, a very violent local storm passed over Louisville, with some damage to property and heavy rain. Early on the morning of the 16th a severe thunder-storm broke over Aurora, Illinois, and swept the country around, causing considerable damage to crops. On the 17th and 18th, as the depression-centre moved east towards the Middle Atlantic coast, violent storms were experienced in Virginia.

No. VI. passed almost entirely beyond the field of observation, north of the Lakes, during the 21st and 22d. It was followed by light rains in the Lake region, and more considerable rain-fall east and northeast of the Lakes. But it was, otherwise, of no special significance.

No. VII. originating west of Lake Superior on the 24th, advanced slowly over the Lake, and quickly disappeared to the northeastward on the night of the 25th, apparently moving towards Hudson's Bay. It was preceded and followed by rain on and near its pathway, and by high winds on Lake Huron, but it was not widely felt within the scope of the meteorological observations.

No. VIII. This was, by far, the most important storm of the month; but, as already stated, its history cannot be given, except in a fragmentary form, in this month's Review, as it had just began its advance eastward when the month of July closed.

It originated in southwestern Kansas on the 29th and 30th, remaining nearly stationary for sixteen hours, when, on the morning of the 31st, it began moving very slowly in an east-northeast direction, towards and up the Ohio valley. In its incipiency, it was marked by very heavy rains in the lower Missouri and central Mississippi valleys; and these rains, at an early period of its development, extended eastward to the Ohio valley. Some of the larger rain-falls, which occurred in eight hours, were at Yankton, 1.45 inches, and at Louisville, 2.09 inches on the night of the 29th; .98 and .61 inches, respectively, at Leavenworth and Cairo on the 30th; 3.44 inches in eight hours at Keokuk on the 31st, and numerous minor, but very decided, falls on the same day over all the surrounding country, reaching far up the Ohio valley.

(3.) *Local Storms and Tornadoes.*—A few of the local storms have already been noticed, such as were immediately associated with, and whose courses lay along the central paths of the low barometer areas. But many others of serious import, traceable to the interaction of the high and low pressure areas, with their contrary conditions of wind, temperature and moisture, were reported. Among the principal local rain-storms and thunder-storms may be mentioned the following:

From the 9th to the 12th, large quantities of rain fell in Middle Tennessee, and on the 12th, the precipitation between Nashville and Decatur was very heavy. On the 13th, a severe local gale swept over Pittsburgh and vicinity. It was considered one of the heaviest storms of the season, occasioning much loss of property and injury to persons. Trees were uprooted, chimneys demolished, and houses and mills damaged. A severe gale and thunder-storm visited Chicago on the night of Thursday, July 15th, and also, on same date, a similar meteor passed over Baltimore with destructive effects. On the 17th a very severe storm visited Petersburg, Va., following the course of the James river, proving very disastrous to houses and the crops in the neighboring country. Equally severe storms deluged the country around New Albany and Evansville, Indiana, drowning the crops in many localities, on the 21st and 22d. Also, in Baltimore, on the 27th, a very damaging thunder and rain-storm prevailed. A rain-storm which set in at Logansport, Indiana, on the 30th, continued, with but little interruption for thirty hours. On the morning of the 15th, about 1 a. m, a severe wind squall passed over Chicago, in which, it is supposed, that a party of balloonists (who ascended the previous afternoon from that city, and were driven by a southwest wind over Lake Michigan,) were caught and perished. The squall came from the northeast. A very heavy thunder-storm was reported from Norfolk on the 6th. On the 25th of July, a violent hail-storm occured at Ula, Colorado.

The great rain-storm which set in at Indianapolis at 10 p m. of the 31st, lasted twelve hours, and the rain-fall was 3.00 inches. Heavy as the rains of the last week in July were at Dayton, and in the valley of the Miami, the precipitation of the 31st was

still heavier, and the crops were greatly damaged. To these local storms already mentioned, must be added that of the 26th, at Abbotsburg, N. C.; that of the 27th at Leavenworth, Kansas, and that of the 28th, at New Albany, Indiana; the heavy rain-storms near Denver, on the 9th, which flooded railroads and forced them to suspend operations temporarily, and on the 17th and 18th, in the adjacent mountains, seriously interfering with mining work; the storm at Shreveport, La., on the 24th; a furious wind-storm at Cape Henry on the 18th, in which the wind blew 72 miles an hour; the hail-storm at Bismarck, D. T., on the 14th, with many hail-stones two inches in diameter and some much larger.

On the 13th, a severe tornado struck West Point, New York, at 7.10 p. m. The first appearance of it was a black cloud shooting over Crow's Nest. Trees were torn up, and broken off and blown some distance. Teams on the roads were blown over and the window-panes in the exposed portions of the buildings were destroyed. The lightning display was very sharp, and the tornado was accompanied by heavy hail. No loss of life took place.

On the 29th of July a tornado, accompanied by a water-spout reported fifty feet high, passed over Great Bay, near Little Egg Harbor, on the New Jersey coast. The meteor came from the southwest, and was very violent, tearing up trees by the root.

At La Crosse, Wisconsin, on the 24th, (at 8:40 p. m.,) after a densely hazy and smoky day, with falling barometer, a whirlwind of about two hundred yards diameter, passed from northwest to southeast, over the city. Houses and trees were thrown down, and roofs and chimneys lifted from the house-tops while the tornado lasted (about two and a half minutes.) The greatest observed velocity of the wind was eighty miles an hour, though it is possible, for a few seconds, it exceeded that. Torrents of rain fell after the passage of the storm, and great damage was done in the neighborhood.

Another tornado visited the southern part of Fountain county, Indiana, on the afternoon of the 27th with destructive effect, and some reported loss of life. This tornado passed near Brownsburg, Indiana; houses were laid low, and much timber levelled with the ground. It also inflicted much loss in Boone and Hendricks counties. At Vergennes, Vt., a very severe storm was experienced, accompanied by hail, and it proved very disastrous to crops.

TEMPERATURE OF THE AIR.

This element will be found, as usual, graphically given by the isothermal lines, and in the table in the lower left-hand corner of Chart No. II. One of the most prominent features of the month's weather has been the extremely high temperature in the South Atlantic and Gulf States. The mean temperature of Augusta, Georgia, e. g., is 84°.6—the highest observed there since the station has been occupied, and supposed to be the highest monthly mean in twenty years.

The lowest temperature reported for the month was 40° Fahrenheit, at Pembina, Dakota Territory, and the highest was 107° Fahrenheit, at Shreveport, Louisiana.

The tabular exhibit shows that the July temperature has been 2°.7 above the normal in the South Atlantic States, and 1°.8 above in the Gulf States. The mean was above the normal in the Middle States and the Lower Lake region. Elsewhere (except on the Pacific coast, which has not yet been heard from) the temperature was either at or below the normal. In the Upper Lake region an extremely low mean is found—2°.1 below that which is generally reported in July. This low temperature was very influential in producing the heavy condensation of rain which flooded the Mississippi and Ohio rivers.

Frosts occurred on the 20th at Mt. Desert, Maine; in Wayne county, Pa., light frosts on the 2d, 3d, 12th, 19th and 20th; at Hot Sulphur Springs, Colorado, slight frosts were